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5.2

On problems of optimization in the configuration space of spherical objects with variable radius

Sergey Yakovlev*, Sergey Shekhovtsov*, Bogdan Skrypka*
* *Department of computer sciences of National Aerospace University, Kharkov, Ukraine*

We consider the configuration space of spherical objects. The generalized variables of this space are the radii and the parameters of the placement of balls. A general mathematical model of the problem is build. Classification of optimization placement problems of balls with variable radii is carried out and numerical methods for their solution are proposed. In addition to the classical packing problem of nonequil balls in a ball of minimum radius, the packing problem of composite balls are considered. Particular attention is paid to the optimal placement of balls of variable radius in regions of complex shape. In this case, the total volume of the balls is maximized. The general unbalance of the set of balls of a given density and the total length of the network connecting the objects are also considered as optimization criteria. The paper describes the results of numerical experiments.
Keywords: packing problem, mathematical model, optimization, composite balls, variable radius

5.3

The manufacturer's pallet loading problem with stability constraints – A case study

António G. Ramos*, Elsa Silva†, Pedro Lopes*, Pedro Ribeiro†
* *INESC TEC and School of Engineering, Polytechnic of Porto,* † *INESC TEC*

The manufacturer's pallet loading problem is one of the most studied problems in the cutting and packing field in the past 50 years. The problem is frequently addressed by reducing the three-dimensional problem to a two-dimensional one, since usually boxes can only rotate about a vertical axis. However, this means that practical additional constraints such as stability are not taken into consideration when determining the two dimensional layout arrangement, limiting the applicability of such solutions in practice.
This work presents a flexible heuristic algorithm that enforces stability constraints based on criteria defined by the user. The algorithm was developed as part of the Adapt Pack project which developed a framework focused on the design and development of new highly flexible modular robotic packaging and palletizing systems.
The algorithm was tested using a large set of real world instances from an industrial company, and the results were compared to the current solutions of the company and were also validated by the company.
Keywords: pallet loading, stability
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5.4

The Skiving Stock Problem and its Application to Wireless Communications

John Martinovic*, Eduard Jorswieck*, Guntram Scheithauer*, Andreas Fischer*
* *Technische Universität Dresden*

We consider a threshold length $L \in \mathbb{N}$, and $m \in \mathbb{N}$ item types that are specified by their length l_i and frequency (of occurence) b_i where $i \in I := \{1, \ldots, m\}$. Constituting a natural (but independent) counterpart of the well-known cutting stock problem, the one-dimensional skiving stock problem (SSP) requires to recompose the given items in order to obtain a maximal number of objects each having a total length of at least L.
Besides its original application in industrial production and recycling, the SSP plays an important role whenever an efficient and sustainable use of given resources is desired, e.g., for the allocation of wireless users within a given frequency range. Due to the considerably increased demand for wireless connectivity, in recent years, the natural radio spectrum became an important and scarce resource. Normally, it is regulated by governmental entities and fixed parts of it are assigned to licensed holders for a long time. However, for large parts of the licensed spectrum the utilization may be very low leading to many wasted vacant frequency intervals. Since these spectrum holes are typically too small to single-handedly satisfy the bandwidth requirements of (given) secondary users (SUs), several of them have to be combined in order to obtain sufficiently large transmission channels. Without further conditions, the homogeneous case of this allocation problem corresponds to an ordinary skiving stock problem. However, due to hardware limitations, further practical constraints have to be incorporated leading to a generalized problem setting.
This talk presents an introduction to the skiving stock problem and discusses its application to resource allocation problems arising in the field of wireless communications. Besides stating some basic theoretical properties and